

auto Return

Chapter 3 Unsafe Features

```
template <int DDL, int MDL, int TDL, int DDR, int MDR, int TDR>
auto operator/(Unit<DDL,MDL,TDL> lhs, Unit<DDR,MDR,TDR> rhs)
{
    return Unit<DDL-DDR, MDL-MDR, TDL-TDR>(lhs.value() / rhs.value());
}
```

The return types for the multiplicative **operators** are somewhat awkwardly long, and without deduced **return types**, those long names would need to appear twice, once in the function declaration and once in the **return statement**.

As a workaround, **operator*** and **operator/** could introduce a defaulted **template parameter** to avoid the repetition of the return type:

```
template <int DD1, int MD1, int TD1, int DD2, int MD2, int TD2,
          typename R = Unit<DD1+DD2, MD1+MD2, TD1+TD2>>
R operator*(Unit<DD1,MD1,TD1> lhs, Unit<DD2,MD2,TD2> rhs)
{
    return R(lhs.value() * rhs.value());
}
```

However, the workaround does not apply to **nontemplated functions**, such as `kineticEnergy`.

We can now use these operations to implement a function that returns the kinetic energy of a moving object:

```
auto kineticEnergy(Kilograms m, Mps v)
    // Return the kinetic energy of an object of mass m moving at velocity v.
{
    return m * (v * v) / Scalar(2);
}
```

The return type of this formula is determined automatically, without expressing the **Unit template arguments** directly. The returned unit is a joule, which can also be described as a kilogram * meter²/second², as our test program illustrates:

```
#include <type_traits> // std::is_same

void f1()
{
    using Joules = Unit<2, 1, -2>; // energy in joules

    auto ke = kineticEnergy(Kilograms(4.0), Mps(12.5));
    static_assert(std::is_same<decltype(ke), Joules>::value, "");
}
```

Because of automatic **return-type deduction**, naming the **Unit** instantiation of each intermediate computation within `kineticEnergy` was unnecessary. The **static_assert** in the code above proves that our formula has returned the correct final unit.